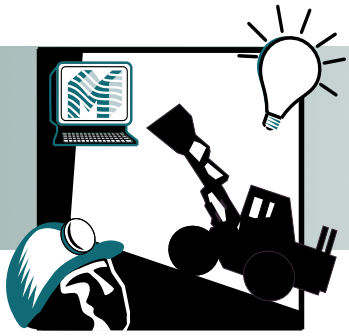
MINING

Project Fact Sheet



COMMINUTION CIRCUIT OPTIMIZATION

BENEFITS

- Saves energy by eliminating overgrinding of material
- Reduces the amount of unusable fines generated

APPLICATION

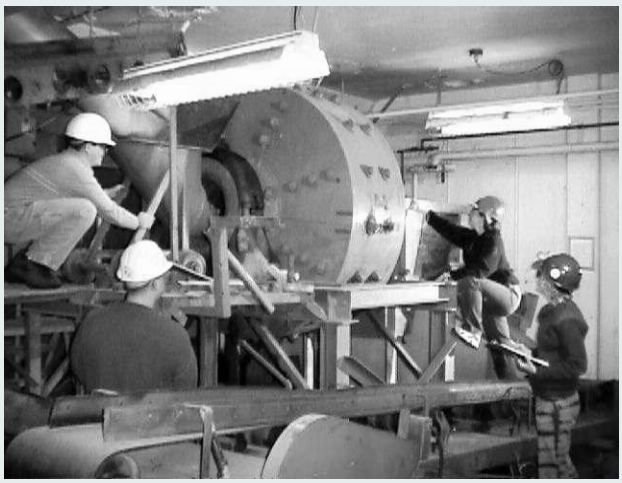
This research will benefit the mining, concrete, mineral products, and energy production industries. These industries will benefit from the reduction of energy consumption and materials waste in their comminution operations.

COMMINUTION CIRCUIT OPTIMIZATION ELIMINATES OVERGRINDING OF MATERIALS, SAVING ENERGY

This project will use comminution modeling to study methods for optimizing the product size distribution so that the amount of excessively fine material produced can be minimized. Comminution is any process where particles are crushed, ground, or otherwise broken to reduce their particle size. Crushing and grinding of various feedstocks is a critical operation in the comminution phase of mining. It is necessary to liberate valuable minerals from waste constituents so that they can be separated, and for producing products with the correct particle size. However, comminution is both energy-intensive and expensive, with tremendous room for improvement. Optimization of full-scale comminution processes by direct experimentation is difficult and expensive because of the cost of modifying and operating the circuits to conduct these experiments. Mathematical simulation of the process is therefore necessary in order to make a preliminary determination of the most promising routes for optimizing the processes.

This project will model alternative circuit arrangements to determine methods for minimizing overgrinding and whether new technologies, such as high-pressure roll crushing, can be used to alter particle breakage behavior to minimize fines production. It will also use circuit simulation to investigate methods to optimize comminution circuits. The main emphasis will be on determining what improvements can be made by changes to flowsheets of existing comminution circuits. This will allow for a reduction of the amount of unusable fines generated and eliminate overgrinding of material.

PILOT-SCALE AUTOGENOUS MILL



Students preparing Michigan Technological University's pilot-scale autogenous mill for project testing.

Project Description

Objective: To develop mathematical models which will help save large amounts of energy in grinding mills. This will be accomplished by minimizing the production of overground fine particles, and so reducing the amount of energy and materials wasted in producing these particles.

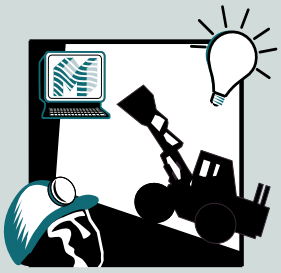
Progress and Milestones

This project includes the following activities:

- Determine, through plant sampling and laboratory tests on actual feed material, what the values of selection, breakage and classification functions are for the processes under study, and determine the actual performance of real processes under specified sets of conditions.
- Conduct simulated experiments where the process layout and operating conditions are varied to determine what can be done to produce the maximum throughput with the greatest energy efficiency.
- Optimize the particle size distribution of the simulated circuit product.
- Investigate the effectiveness of advanced technologies that include both advanced comminution devices (such as grinding rolls) and improved particle sizing devices (classifiers, screens, and related mechanisms).
- Plan modifications to existing circuits based on the mathematical models, so that the models can be confirmed on a pilot-plant scale and in full-scale operating plants.

Commercialization Plan

In order to ensure wide dissemination, the results of this research will be published in journals and incorporated into courses taught at Michigan Technology University. The Minerals and Metallurgical Processing Journal will publish a special issue on process simulation in comminution circuits where the world's top scientists working in this area will be invited to present their results. The project partners will also develop a short course for industry to train their personnel in the most effective use of the results from this project.



PROJECT PARTNERS

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